

# KARLY M. PITMAN

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## **PROFILE:**

- Research interests and techniques: planetary surfaces and atmospheres, small bodies (satellites, asteroids, meteorites), astrophysics (interstellar medium, dust), remote sensing, radiative transfer modeling, laboratory and field spectroscopy at visible to far infrared wavelengths

## **EDUCATION:**

<b>Ph.D., Physics</b>	<b>2005</b>
<u>Thesis Title:</u> "Radiative Transfer Modeling of Thermal IR Emissivity Spectra: Applications to Martian Regolith Observations"	
<b>M.S., Physics</b>	<b>2002</b>
LOUISIANA STATE UNIVERSITY, Baton Rouge, Louisiana	
<b>A.B., Astronomy and Geology (Correlate: Physics)</b>	<b>1999</b>
VASSAR COLLEGE, Poughkeepsie, New York	
<u>Thesis Title:</u> "Review of Lunar and Asteroidal Materials and the Classification of Ordinary Chondritic Meteorites"	

## **AWARDS AND HONORS:**

Nomination, Annie Jump Cannon Award, American Astronomical Society	<b>2007</b>
NASA Postdoctoral Program Fellowship, NASA/ORAU/JPL	<b>2006-p</b>
NASA Planetary Science Summer School, Jet Propulsion Laboratory	<b>2004</b>
LPI Graduate Fellowship, Lunar & Planetary Institute	<b>2003</b>
Board of Regents Fellowship, The Graduate School, Louisiana State University	<b>1999-2003</b>
Frances W. Pick Scholarship, Vassar College	<b>1995-1999</b>
Westlake Scholarship, Westlake Foundation, St. Louis, MO	<b>1995-1999</b>

## **POSITIONS HELD:**

<b>Associate Research Scientist</b>	<b>2008-p</b>
PLANETARY SCIENCE INSTITUTE, Tucson, AZ	
<b>NASA Postdoctoral Program Fellow</b>	<b>2006-p</b>
JET PROPULSION LABORATORY, Pasadena, CA	
Adviser: B. J. Buratti (Division 32, Asteroids, Comets, Satellites Group)	
Research area: Radiative Transfer Modeling; Titan Atmosphere & Surface; Saturnian Icy Satellites	
Leader in U.S. development of surface-atmospheric radiative transfer separation methods for Cassini Visual & Infrared Mapping Spectrometer (VIMS) data from Titan, drawing together technology and experts from other planetary science fields. Responsible for data reduction with ENVI and ISIS software, hyperspectral analysis and mapping of surface composition and cloud cover, and archiving of incoming and past data from nominal Cassini mission for Saturnian moons; prepared reports on VIMS results for Titan Orbiter Science Team. Responsible for the interviewing, selection, and direct supervision of undergraduate workers.	

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### **Postdoctoral Research Associate**

**2005 - 2006**

Dept. of Earth & Planetary Sciences, WASHINGTON UNIVERSITY, St. Louis, MO

Advisers: A. M. Hofmeister, A. K. Speck

Research area: Laboratory FT-IR Spectroscopy; Mineral Physics

Utilized laboratory reflectance and absorbance spectroscopy to infer composition and physical properties of circumstellar and interstellar dust. Derived optical constants using Kramers-Kronig and classical Lorentz-Lorenz dispersion theory, e.g., new optical constants for silicon carbide, a major dust carrier in carbon stars, C-rich stellar outflows, novae, and supernovae, to address community need for bulk properties. Developed public database of mid- and far-infrared high resolution spectra of interstellar dust grain analogs for direct delivery to the community.

### **Research Assistant**

**2003 - 2005**

SPACE SCIENCE INSTITUTE, Boulder, CO

Adviser: M. J. Wolff

Research area: Planetary Science; Mars Surface and Atmospheric Modeling

Derived theoretical phase functions for Mars Global Surveyor Thermal Emission Spectrometer Emission Phase Function sequences of nonspherical Mars aerosols via quad-precision T-matrix computer models. Performed numerical discrete ordinates radiative transfer modeling of planetary regolith and compacted grains. Explored different particle topologies and ensembles of clustered spheres, utilizing multisphere code SCSMFO and geometrical optics codes.

### **LPI Graduate Fellow**

**2003**

LUNAR & PLANETARY INSTITUTE, Houston, TX

Adviser: A. H. Treiman

Research area: Mars Meteorite Analysis (XRD, EMP)

Executed X-ray diffraction, optical microscopy, and electron microprobe analyses on Mars meteorite thin sections. Utilized MELTS software to generate computer models of parent compositions.

### **Guest Researcher**

**2002 - 2004**

MARS SPACE FLIGHT FACILITY, ARIZONA STATE UNIVERSITY, Tempe, AZ

Host: J. L. Bandfield

Research area: Laboratory & Field IR Spectroscopy of Mars Analog Terrain

Performed laboratory FT-IR spectroscopy on quartz, clay, sulfate, and Mars-relevant compounds. Improved experimental design of sample acquisition and containment, coordinating resources at ASU and LSU, including directing an undergraduate assistant, machine shop technicians, and external laboratories. Designed and implemented remote sensing thermal infrared directional emissivity field experiment with Designs & Prototypes™ micro-FT-IR field portable spectrometer. Wrote proposals and negotiated between National Park Services, ASU, LSU, and SSI.

### **Graduate Research Assistant**

**1999 - 2005**

Dept. of Physics & Astronomy LOUISIANA STATE UNIVERSITY, Baton Rouge, LA

Adviser: G. C. Clayton

Research area: Astrophysics of the ISM; Mineralogy of Interstellar Dust

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Determined through research that, as of 2000, no QSO was known to display the broad absorption feature at 2175 Angstroms, disproving earlier reports of the feature in QSOs. Performed radiative transfer modeling of light scattering and absorption properties of interstellar dust grains.

Maintained research group websites and represented the group at conferences.

## **Undergraduate Research Assistant 1995 - 1999**

Dept. of Geology & Geography, VASSAR COLLEGE, Poughkeepsie, NY

Advisers: M. Sullivan, K. M. Menking

Research area: Volcanology; Geomorphology; Paleoclimatology

Performed X-ray diffraction and optical microscopy analyses on rocks and minerals. Built weather stations and ordered, assembled, and installed equipment and supplies for new laboratory. Curated mineral collections and topographic map library and acquired field samples.

## **COMPUTER SKILLS:**

Platforms: UNIX, Linux, PC, Mac OS X

Languages: FORTRAN77, Fortran 90/95, C/C++, shell scripting, HTML, Perl, VBScript

Packages: IDL, ENVI, MATLAB, ISIS, Mathematica, Excel

Advanced: Parallel computing experience on CaSPer, Supermike clusters at LSU

High performance computing on JPL supercomputing cluster

Light systems administration on Mac OS X and Linux machines

## **PROFESSIONAL SOCIETIES AND OFFICES HELD**

American Astronomical Society 2000 – p

- AAS Division for Planetary Sciences section

American Geophysical Union 2000 – p

- AGU Mineral and Rock Physics section

American Physical Society 1999-2005

Association for Women In Science (AWIS) 2000-2005

- AWIS-Baton Rouge, LA chapter: President (2000-2003), Webmaster (2002-2003)

## **REVIEW PANELS AND SERVICE ACTIVITIES**

Session Chair, AAS-DPS, LPSC, Spring AGU meetings 2006-2007

Referee for papers submitted to *Journal of Geophysical Research – Planets*, 2006-2008  
*IEEE Transactions on Geoscience and Remote Sensing*, Titan After Cassini book

External Reviewer, NASA Proposal Review Panels for Mars Data Analysis Program (MDAP), 2006  
Planetary Geology & Geophysics (PG&G)

## **PUBLICATIONS**

- 2008 **Pitman, K. M.**, Buratti, B. J., Mosher, J. A., Bauer, J. M., Momary, T. W., and Brown, R. H. *First high solar phase angle observations of Rhea using Cassini VIMS: Upper limits on water vapor and geologic activity*, Astrophysical Journal Letters, vol. 680, issue 1, pp. L65-L68.
- 2008 **Pitman, K.M.**, Hofmeister, A.M., Corman, A.B., and Speck A.K. *Optical properties of silicon carbide for astrophysical applications I. New laboratory infrared reflectance spectra and optical constants*, Astronomy and Astrophysics, vol. 483, issue 2, pp. 661-672.
- 2008 Barnes, J. W., Brown, R. H., Soderblom, L., Sotin, C., Le Mouelic, S., Rodriguez, S., Jaumann, R., Beyer, R. A., Buratti, B. J., **Pitman, K.**, Baines, K. H., Clark, R., and Nicholson, P. *Spectroscopy, morphometry, and photoclinometry of Titan's dunefields from Cassini/VIMS*, Icarus, vol. 195, issue 1, pp. 400-414.
- 2007 Hofmeister, A.M., and **Pitman, K.M.** *Evidence for kinks in structural and thermodynamic properties across the forsterite-fayalite binary from thin-film IR absorption spectra*, Physics and Chemistry of Minerals, vol. 34, issue 5, pp. 319-333.
- 2006 **Pitman, K.M.**, Speck, A.K., and Hofmeister, A.M. *Challenging the identification of nitride dust in extreme carbon star spectra*, Monthly Notices of the Royal Astronomical Society, vol. 371, issue 2, pp. 1744-1754.
- 2005 **Pitman, K.M.**, Wolff, M.J., and Clayton, G.C. *Application of modern radiative transfer tools to model laboratory quartz emissivity*, Journal of Geophysical Research – Planets, vol. 110, issue E08003, doi:10.1029/2005JE002428.
- 2000 **Pitman, K.M.**, Clayton, G.C., and Gordon, K.D. *The 2175 Angstrom Extinction Bump in QSO Spectra*, The Publications of the Astronomical Society of the Pacific, vol. 112, issue 770, pp. 537-541.

## **Manuscripts in review:**

- 2008 Rodriguez, S., Le Mouelic, S., Rannou, P., Sotin, C., Griffith, C. A., Barnes, J. W., **Pitman, K. M.**, Tobie, G., Buratti, B. J., Brown, R. H., Nicholson, P. D., Baines, K. H., Clark, R. N., Hirtzig, M., and the Cassini VIMS Team, *Global mapping of Titan's clouds with the VIMS imaging spectrometer onboard Cassini from July 2004 to December 2007*, submitted to Nature
- 2008 Hofmeister, A.M., **Pitman, K.M.**, Corman A.B., Speck A.K., and Goncharov, A. *Optical properties of silicon carbide for astrophysical applications II. Single-crystal absorption spectra*, submitted to Astrophysical Journal

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- 2008 Barnes, J.W., Brown, R.H., Soderblom, J.M., Jaumann, R., Jackson, B., Le Mouelic, S., Sotin, C., Buratti, B.J., **Pitman, K.M.**, Baines, K.H., Clark, R.N., Nicholson, P.D., Turtle, E.P., and Perry, J., *Shoreline features of Titan's Ontario Lacus from Cassini/VIMS observations*, submitted to Icarus

### **Manuscripts in preparation:**

- 2008 **Pitman, K.M.**, *Titan's solar phase curve from Cassini VIMS observations*, submitted to Geophysical Research Letters
- 2008 **Pitman, K.M.**, Buratti, B.J., Mosher, J.A., Brown, R.H., Baines, K.H., Clark, R.N., Jaumann, R., and Nicholson, P.D. *Disk-integrated bolometric Bond albedos and rotational light curves of Saturnian satellites from Cassini VIMS*, submitted to Icarus
- 2008 **Pitman, K.M.**, Dijkstra, C.R., Hofmeister, A.M., and Speck, A.K. *Room temperature forsterite and fayalite absorbances*, submitted to Monthly Notices of the Royal Astronomical Society
- 2008 **Pitman, K.M.**, Bauer, J.M., Buratti, B.J., Brown, R.H., Sotin, C., Barnes, J.W., Le Mouélic, S., Baines, K.H., Clark, R.N., Jaumann, R., and Nicholson, P.D. *Exploring methods to rule out surface compositional types on Titan using Cassini VIMS T20 flyby spectra*, submitted to Icarus
- 2009 **Pitman, K.M.**, Bandfield, J. L., and Wolff, M. J. *TES Phase Effects and Thermal Infrared Directional Emissivity Field Measurements*, submitted to Journal of Geophysical Research – Planets
- 2009 **Pitman, K.M.**, and Treiman, A.H. *Compositional Controls on the Formation of Kaersutite Amphibole in Shergottite Meteorites*, submitted to Meteoritics & Planetary Science

### **CONFERENCE PROCEEDINGS, INVITED TALKS, & PRESENTATIONS**

- 2008 West, R. A., **Pitman, K. M.**, Martonchik, J. V., Dumont, P. J., Titan's stratospheric haze and its effect on surface contrast, Titan After Cassini-Huygens Book Symposium, Corpus Christi, TX, July 7-11 2008.
- 2008 **Pitman, K. M.**, Titan's surface and atmosphere as viewed by Cassini VIMS, Planetary Science Institute, July 31 2008.
- 2008 **Pitman, K. M.**, Titan's surface and atmosphere as viewed by Cassini VIMS, Planetary Science Seminar, Division of Geological and Planetary Sciences, California Institute of Technology, April 15 2008.
- 2008 **Pitman, K. M.**, SiC optical constants: mid- to far-IR, UV (you know you want them), Space Telescope Science Institute, March 2008.
- 2008 **Pitman, K. M.**, Buratti, B. J., West, R. A., Dumont, P. J., Baines, K. H., Wolff, M. J., Brown, R. H., & the Cassini VIMS Team, Titan surface-atmospheric separation models for Cassini VIMS: Spherical shell radiative transfer models, 39<sup>th</sup> Lunar and Planetary Science Conference, March 10-14 2008, League City, TX, LPI Contribution No. 1391, p. 1911.

- 2008 **Pitman, K. M.**, Buratti, B. J., Mosher, J. A., Bauer, J. M., Momary, T. W., Brown, R. H., Nicholson, P. D., Hedman, M. M., & the Cassini VIMS Team, First high solar phase angle observations of Rhea using Cassini VIMS: Upper limits on geologic activity, 39<sup>th</sup> Lunar and Planetary Science Conference, Mar. 10-14 2008, League City, TX, LPI Contribution 1391, p. 1387.
- 2008 **Pitman, K. M.**, Titan's surface and atmosphere as viewed by Cassini VIMS, Planetary Ices Seminar, Jet Propulsion Laboratory, California Institute of Technology, March 7 2008.
- 2007 **Pitman, K. M.**, Buratti, B. J., Baines, K. H., West, R. A., Dumont, P., Wolff, M. J., Brown, R. H., Bellucci, G., Bibring, J., Capaccioni, F., Cerroni, P., Clark, R. N., Combes, M., Coradini, A., Cruikshank, D. P., Drossart, P., Formisano, V., Jaumann, R., Langevin, Y., Matson, D. L., McCord, T. B., Mennella, V., Nelson, R. M., Nicholson, P. D., Sicardy, B., Sotin, C., & the Cassini VIMS Team, Surface-atmospheric separation models for Titan: Plane-parallel vs. spherical shell radiative transfer solutions for Cassini VIMS data, American Geophysical Union, Fall Meeting 2007, abstract #P23B-1357.
- 2007 Buratti, B. J., **Pitman, K. M.**, Baines, K., Sotin, C., Brown, R. H., Clark, R. N., Nicholson, P. D., Griffith, C. A., Le Mouelic, S., and Momary, T., A mid-latitude cloud eruption on Titan observed by the Cassini Visual Infrared Mapping Spectrometer (VIMS) in July 2007, American Geophysical Union, Fall Meeting 2007, abstract # P23B-1358.
- 2007 Barnes, J. W., Brown, R. H., Soderblom, L. A., Sotin, C., Jaumann, R., LeMouelic, S., Rodriguez, S., Beyer, R. A., Buratti, B. J., **Pitman, K.**, Baines, K. H., and Nicholson, P. D., Photoclinometry, morphometry, and spectroscopy of Titan's sand dunes from Cassini/VIMS, American Geophysical Union, Fall Meeting 2007, abstract #P23B-1354.
- 2007 **Pitman, K. M.**, Buratti, B. J., West, R. A., Dumont, P., Baines, K. H., Wolff, M. J., Brown, R. H., Griffith, C., Soderblom, L., Clark, R., Jaumann, R., Nicholson, P., Sotin, C., & the Cassini VIMS Team, Cassini VIMS: Developing surface-atmospheric separation models for Titan, Workshop on Planetary Atmospheres, Nov. 6-7 2007, Greenbelt, MD, LPI Contribution No. 1376, p. 96-97.
- 2007 **Pitman, K.M.**, Buratti, B.J., Baines, K.H., West, R.A., Wolff, M.J., Brown, R.H., Sotin, C., Jaumann, R., Nicholson, P.D., Clark, R.N., & the Cassini VIMS Team, Development of Titan atmospheric removal models for Cassini VIMS data, AAS, DPS meeting #39, #56.03.
- 2007 Barnes, J. W., Brown, R. H., Sotin, C., Buratti, B. J., Jaumann, R., LeMouelic, S., Rodriguez, S., **Pitman, K.**, Baines, K. H., and Nicholson, P. D., Cassini/VIMS near-infrared imaging and spectroscopy of Titan's sand dunes, AAS, DPS meeting #39, #44.06.
- 2007 Barnes, J. W., Brown, R. H., Soderblom, L., Sotin, C., LeMouelic, S., Rodriguez, S., LeCorre, L., Buratti, B. J., **Pitman, K. M.**, Clark, R. N., Jaumann, R., and Hayne, P., Titan as an icy moon: Evidence for cryovolcanism and tectonics from Cassini/VIMS, Workshop on Ices, Oceans, and Fire: Satellites of the Outer Solar System, Aug. 13-15 2007, Boulder, CO, LPI Contribution No. 1357, p. 13-14.
- 2007 **Pitman, K.M.**, Buratti, B.J., Momary, T., Bauer, J.M., Baines, K.H., West, R.A., Wolff, M.J., Brown, R.H., Sotin, C., Jaumann, R., Nicholson, P., Clark, R., & the Cassini VIMS Team, 2006-2007 progress report: Titan VIMS projects at JPL, Titan Surface Workshop, Jul. 16-17 2007, U.S. Geological Survey – Flagstaff, AZ.
- 2007 **Pitman, K.M.**, Buratti, B.J., Baines, K.H., West, R.A., Wolff, M.J., Brown, R.H., and the Cassini VIMS Team. Projects to probe Titan's surface composition and development of

- atmospheric removal models for Cassini VIMS data, AGU 2007 Joint Assembly Meeting, May 22-25 2007, Acapulco, Mexico, #P41B-12.
- 2007 **Pitman, K.M.**, Buratti, B.J., Baines, K.H., West, R.A., and Wolff, M.J. Probing Titan's surface via atmospheric radiative transfer correction methods, 38<sup>th</sup> Lunar and Planetary Science Conference, March 12-16 2007, League City, TX, LPI Contribution No. 1338, p. 1164.
  - 2007 Buratti, B.J., **Pitman, K.M.**, Brown, R.H., Barnes, J.W., Baines, K., Clark, R., Jaumann, R., Nicholson, P., and Sotin, C. Exploring methods to rule out surface compositional types on Titan using Cassini VIMS T20 data, 38<sup>th</sup> Lunar and Planetary Science Conference, March 12-16 2007, League City, TX, LPI Contribution No. 1338, p. 1165.
  - 2007 **Pitman, K.M.**, Hofmeister, A.M., and Speck, A.K. Laboratory infrared optical constants and reflectance spectra of silicon carbide, 2007 AAS/AAPT Joint Meeting, AAS meeting # 209, #06.02.
  - 2006 **Pitman, K.M.**, and Hofmeister, A.M. Evidence for kinks in structural and thermodynamic properties across the forsterite-fayalite binary from IR spectra, AGU, Fall Meeting 2006, #MR05-5635.
  - 2006 **Pitman, K.M.**, Hofmeister, A.M., and Speck, A.K. Challenging the identification of silicon nitride dust in extreme carbon stars, Why Galaxies Care About AGB Stars: Their Importance as Actors and Probes, August 7-11 2006, Universitat Wien, Vienna, Austria.
  - 2006 **Pitman, K.M.**, Bandfield, J.L., and Wolff, M.J. MGS-TES Phase Effects and Thermal Infrared Directional Emissivity Field Measurements of Martian Analog Sites, 37<sup>th</sup> Lunar and Planetary Science Conference, March 13-17 2006, League City, TX, #1336.
  - 2006 **Pitman, K.M.**, and Hofmeister, A.M. Thin film absorbance spectra of forsterite and fayalite dust grains, 37<sup>th</sup> Lunar and Planetary Science Conference, March 13-17 2006, League City, TX, #1338.
  - 2006 **Pitman, K.M.**, Hofmeister, A.M., and Speck, A.K. Challenging the identification of silicon nitride dust in extreme carbon stars, NASA Laboratory Astrophysics Workshop, February 14-16 2006, Dept. of Physics, University of Las Vegas – Nevada.
  - 2005 **Pitman, K.M.**, Wolff, M.J., and Clayton, G.C. Nadir Emissivity Radiative Transfer Models For Planetary Regolith: Current State of the Art, AAS 205<sup>th</sup> meeting.
  - 2004 **Pitman, K.M.**, Wolff, M.J., and Clayton, G.C. Theoretical Radiative Transfer Emissivity Modeling of Quartz Fines At Nadir Incidence: Sensitivity Studies With Applications to Planetary Regolith, AGU, Fall Meeting 2004, #P11A-0953.
  - 2004 **Pitman, K.M.**, Wolff, M.J., and Clayton, G.C. Nadir Emissivity Radiative Transfer Model Sensitivity Studies With Applications to Martian Regolith Fine Fraction, AAS, DPS #36, #47.09.
  - 2004 **Pitman, K.M.** and Treiman, A.H. Compositional Controls on the Formation of Kaersutite Amphibole in Shergottite Meteorites, 35<sup>th</sup> Lunar and Planetary Science Conference, March 15-19 2004, League City, TX, #1177.
  - 2003 **Pitman, K.M.**, Wolff, M.J., and Clayton, G.C. Static Structure Factor Effects on Theoretical Emissivity Profiles of Martian Surface Dust, AAS, DPS meeting #35, #19.12.
  - 2003 **Pitman, K.M.**, Wolff, M.J., Bandfield, J.L., and Clayton, G.C. Using Nadir and Directional Emissivity as a Probe of Particle Microphysical Properties, Astrophysics of Dust, Estes Park, CO, May 26-30 2003, ed. Adolf Witt.
  - 2002 **Pitman, K.M.**, Wolff, M.J., Bandfield, J.L., and Clayton, G.C. Using Directional Emissivity as a Probe of Particle Microphysical Properties, AAS, DPS meeting #34, #15.26.

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- 2001 Wolff, M.J., Clancy, R.T., **Pitman, K.M.**, Bell, J.F., and James, P.B. Constraints on Martian Aerosol Particles Using MGS/TES and HST Data: Shapes, AGU, Fall Meeting 2001, #P32E-05.
- 2001 **Pitman, K.M.**, Wolff, M.J., Bandfield, J.L., Clancy, R.T., and Clayton, G.C. Directional Emissivity Effects on Martian Surface Brightness Temperatures, AAS, DPS meeting #33, #36.01; Bulletin of the American Astronomical Society, vol. 33, p. 1102.
- 2001 Wolff, M.J., Clancy, R.T., **Pitman, K.M.**, Christensen, P.R., and Whitney, B.A. Mars Aerosol Studies with the MGS TES Emission Phase Function Observations: Opacities, Particle Sizes, and Ice Cloud Types, AAS, DPS meeting #33, #34.06; Bulletin of the American Astronomical Society, vol. 33, p. 1098.
- 2000 Wolff, M.J., Clancy, R.T., and **Pitman, K.M.** On the nature of Martian composite dust/water-ice aerosols, AAS, DPS meeting #32, #54.05; Bulletin of the American Astronomical Society, vol. 32, p. 1104.
- 2000 **Pitman, K.M.**, Wolff, M.J., Clancy, R.T., and Clayton, G.C. On the shape of martian dust and water ice aerosols, AAS, DPS meeting #32, #51.09; Bulletin of the American Astronomical Society, vol. 32, p. 1095.

## REFERENCES

Dr. Michael J. Wolff  
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262-790-1356 (phone)  
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